

Amendments to the Drawings:

The attached sheet of drawings includes a correction to the sole Figure of the application, as filed. This Replacement Sheet replaces the original sheet of the sole Figure of the application, as filed. In the figure, the label “FIGURE 1” is replaced with “FIGURE”.

Attachment: One Replacement Sheet

REMARKS

Non-elected claims 14-16 have been canceled, and new claims 32-34 directed to the elected invention of the present application have been added. No new matter was added. Thus, elected claims 20-34 are pending for further prosecution. Non-elected method claims 1, 2 and 17-19 also remain in the application, as withdrawn. Non-elected independent claim 1 has been amended to depend from elected independent claim 24, and thus includes all the limitations of claim 24. Rejoinder of non-elected method claims 1, 2 and 17-19 is respectfully requested should the elected base claim be allowed. Arguments for the patentability of the elected claims over the prior art of record are presented. Accordingly, Applicants respectfully submit that the present application is in condition for allowance.

I. Drawing Objection

In the non-final Office Action dated October 16, 2008, the drawing, as filed, was subject to an objection since the single drawing is labeled "FIG. 1".

A corrected Replacement Sheet of drawing is provided. The drawing is labeled "FIGURE" instead of FIG. 1. No new matter was added.

Accordingly, Applicants respectfully request reconsideration and removal of the objection to the drawing.

II. Claim Rejections - 35 USC §102(b)/ §103(a)

- A. *In the non-final Office Action dated October 16, 2008, claims 20-31 are rejected under 35 USC §102(b) as being anticipated by JP 2001-031419 A or, in the alternative, are rejected under 35 USC §103(a) as being obvious in view of JP 2001-031419 A.*

JP '419 is cited for disclosing a copper sulfate which is vaguely indicated as being “high-purity”. From the use of this relative terminology, it is reasoned in the Office Action that the mere presence of the term “high purity” corresponds to “low impurity content”, with “low” being undefined and indefinite. It is also reasoned in the Office Action, that any differences between the subject matter defined in the claims of the present application and that disclosed by JP '419 “would have been obvious to one of ordinary skill in the art at the time the invention was made as a *routine modification*”. Applicants respectfully disagree and respectfully request reconsideration.

The terms “high purity” and “low impurity content” are relative terms that are essentially meaningless unless otherwise defined. As explained in the present application, as filed, on page 1, lines 22-27, there are many end-uses for copper sulfate and commercially available copper sulfate having a purity of 95wt% to 99.9wt% may well be considered “high purity” depending on their expected use.

The present invention relates to a copper sulfate that provides an electrolytic solution for electroplating copper for the purposes of forming circuits and/or wiring of semiconductor devices. Semiconductor devices are continually being miniaturized and as the wiring and circuits become smaller, the presence of impurities, even at “low” levels, becomes a problem and causes such semiconductor devices to be defective. Thus, the present invention advances the state of the art with respect to electrolytic solutions for semiconductor manufacture.

All pending claims of the present application require the copper sulfate to have a purity of 99.99wt% (4N) or higher. New dependent claim 34 requires a purity of 99.999wt% (5N) or higher. No new matter was added; for example, see the present application, as filed, on page 6, line 20.

JP '419 fails to define the level of purity of the copper sulfate. (A full English language machine-translation of JP '419 is provided in a Supplemental Information Disclosure Statement filed herewith.) While JP '419 may use the relative terminology "high-purity", it fails to provide any definition. Accordingly, for this reason, Applicants respectfully submit that independent claim 24 of the present application is neither anticipated nor obviated by JP '419. In addition, one of ordinary skill in the art would have no common sense reason for believing the refining method of JP '419 would produce the same results as the method of the present invention since the methods are completely different as discussed in greater detail below.

Claims 20-23, 25-28 and 32-34 of the present application require the copper sulfate to have a content of transition metals of 3wtppm or less. In addition, new dependent claim 33 requires the copper sulfate to have a content of nickel of 1wtppm or less, and new dependent claim 34 requires the copper sulfate to have a content of nickel of 0.2wtppm. No new matter was added; for example, see the present application, as filed, on page 6, lines 18-19, and page 9, lines 10-11.

JP '419 acknowledges that copper sulfate contains a large amount of nickel as an impurity because, as stated in Paragraph No. 0004 of JP '419, "the action of nickel is almost the same as that of copper". JP '419 provides a method for reducing the amount of nickel in copper sulfate. In Paragraph Nos. 0015 and 0018, the method disclosed by JP '419 is capable of reducing the content of Ni in a copper sulfate "D" to 0.0004% (4wtppm). JP '419 considers this sufficiently "low" and thus ignores the need for further reduction.

As stated above, the claims of the present invention require a content of transition metals to be 3wtppm or less. JP '419 only reduces the content of nickel, and even the nickel of JP '419 by itself is greater than that required by the present invention for all transition metals (3wtppm or less). Further, claim 33 of the present application specifically requires nickel to be 1wtppm or less and claim 34 requires a nickel content of only 0.2wtppm. Accordingly, for at least this reason, Applicants respectfully submit that the claims of the present application are neither anticipated nor obviated by JP '419. In addition, one of ordinary skill in the art would have no common sense reason for believing the refining method of JP '419 would produce the same results as the method of the present invention since the methods are completely different.

The method of JP '419 is to melt copper sulfate crystals in purified water and to collect and subsequently use recrystallized sediment to form copper sulfate with reduced nickel. For example, see Paragraph Nos. 0013-0015 of JP '419 which disclose that purified water is added to 1.3kg of copper sulfate crystals for obtaining an aqueous solution "A" of 2 liters. The pH of solution "A" is 2.0. Solution "A" is mixed powerfully and heated so as to engulf air, is maintained at 85°C or higher for 1 hour, and the solution is evaporated to 1.9 liters. With the concentration at this point in time, even if it is cooled, although it should not be supersaturated and crystals should not be precipitated in terms of solubility, a sediment "B" of a yellow color is generated in the solution "A". Sediment "B" is filtered and separated from solution "A". Sediment "B" is dissolved and recrystallized to form copper sulfate "D". The copper sulfate "D" contains 0.0004wt% (4wtppm) of nickel. Thus, the method of JP '419 uses the recrystallized yellow sediment "B" to form a copper sulfate with reduced nickel.

In contrast, the method of the present invention dissolves copper sulfate in purified water, performs evaporative concentration, and removes the crystals initially precipitated from further processing. For example, see the "FIGURE" of the present application, as filed. By way of

further example, see page 7, lines 13-18, of the present application, as filed, which discloses that 250g of commercially available copper sulfate having a purity level of 99.8wt% was dissolved in 1000ml of purified water at room temperature, and this was heated to 90°C to evaporate water in a prescribed amount, cooled to room temperature, and the initial crystals precipitated and were filtered and removed. Thereafter, on page 8, lines 4-8, the filtration solution from which the initial crystals was removed is reheated, water was evaporated, and this was cooled to room temperature so that the refined copper sulfate crystals precipitate and can be filtered.

As evident from the above comparison, whereas the present invention obtains refined copper sulfate crystal by using a filtration solution obtained by dissolving copper sulfate crystals in purified water, subjecting this to concentration, cooling, and removing crystals initially precipitated, JP '419 is of an entirely opposite technology. JP '419 obtains copper sulfate by using sediment obtained by dissolving copper sulfate in purified water, subjecting this to concentration and cooling, and dissolving the heating the sediment again, and cooling and concentrating this to effect recrystallization.

Based on the significant differences between the methods (which are completely opposite), one of ordinary skill in the art would not reasonable expect the same outcome. For instance, while the nickel of the copper sulfate of JP '419 is reduced to only 4wtppm, the method of the present application can reduce nickel to 0.2wtppm. In addition, JP '419 is concerned only with nickel, and there is no common sense reason to believe that JP '419 can reduce “transition metals” to 3wtppm when it can only reduce nickel, by itself, to 4wtppm. Thus, the differences between the copper sulfate claimed by the present application and that of JP '419 are not obvious and cannot be made by way of “routine modification”. The technical concepts of these methods are opposite and it would not be “routine” to modify JP '419 to match that of the present application.

Further, claims 21-23, 26-28 and 32-34 of the present application require the copper sulfate to have a content of Ag of 1wtppm or less and a content of Cl of 1wtppm. JP '419 fails to disclose or obviate this limitation. While JP '419 may use the relative terminology "high-purity", it fails to provide any definition. Accordingly, for this reason, Applicants respectfully submit that claims 21-23, 26-28 and 32-34 of the present application are neither anticipated nor obviated by JP '419. In addition, one of ordinary skill in the art would have no common sense reason for believing the refining method of JP '419 would produce the same results as the method of the present invention since the methods are completely different as discussed above in detail.

Still further, claims 22, 23, 27, 28 and 32-34 of the present application require the copper sulfate to have a content of alkali metals and alkali earth metals of 1wtppm or less, respectively. JP '419 fails to disclose or obviate this limitation. While JP '419 may use the relative terminology "high-purity", it fails to provide any definition. Accordingly, for this reason, Applicants respectfully submit that claims 22, 23, 27, 28 and 32-34 of the present application are neither anticipated nor obviated by JP '419. In addition, one of ordinary skill in the art would have no common sense reason for believing the refining method of JP '419 would produce the same results as the method of the present invention since the methods are completely different as discussed above in detail.

Finally, claims 23, 28 and 32-34 of the present application require the copper sulfate to have a content of a Si containing oxide of 10wtppm or less. JP '419 fails to disclose or obviate this limitation. While JP '419 may use the relative terminology "high-purity", it fails to provide any definition. Accordingly, for this reason, Applicants respectfully submit that claims 23, 28 and 32-34 of the present application are neither anticipated nor obviated by JP '419. In addition, one of ordinary skill in the art would have no common sense reason for believing the refining

method of JP '419 would produce the same results as the method of the present invention since the methods are completely different as discussed above in detail.

For these reasons, Applicants respectfully request reconsideration and removal of the 35 USC §102(b) and §103(a) rejections of claims 20-31 as being anticipated by or obvious over the copper sulfate with reduced Ni disclosed by JP '419.

B. In the non-final Office Action dated October 16, 2008, claims 20-31 are rejected under 35 USC §102(b) as being anticipated by JP 05-262523 A or, in the alternative, are rejected under 35 USC §103(a) as being obvious in view of JP 05-262523 A.

In the Office Action, it is stated that JP '523 discloses a “high-purity” copper sulfate; however, Applicants respectfully submit that this is an error. A full English language machine-translation of JP '523 has been provided by way of a Supplemental Information Disclosure Statement. At no place in JP '523 does it refer to high purity or steps for refining the purity of copper sulfate. Rather, Paragraph Nos. 0001 and 0004 of JP '523 clearly state that the reference is directed to a low cost method for manufacturing copper sulfate solution directly from metallic copper powder.

The Office Action also states that any differences between the subject matter defined in the claims of the present application and that disclosed by JP '523 “would have been obvious to one of ordinary skill in the art at the time the invention was made as a ***routine modification***”. Applicants respectfully disagree and respectfully request reconsideration.

As explained in the present application, as filed, on page 1, lines 22-27, there are many end-uses for copper sulfate and commercially available copper sulfate having a purity of 95wt% to 99.9wt% may well be considered “high purity” depending on its end-use.

The present invention relates to a copper sulfate that provides an electrolytic solution for electroplating copper for the purposes of forming circuits and/or wiring of semiconductor devices. Semiconductor devices are continually being miniaturized and as the wiring and circuits become smaller, the presence of impurities, even at “low” levels, becomes a problem and causes such semiconductor devices to be defective. Thus, the present invention advances the state of the art with respect to electrolytic solutions for semiconductor manufacture.

All pending claims of the present application require the copper sulfate to have a purity of 99.99wt% (4N) or higher. New dependent claim 34 requires a purity of 99.999wt% (5N) or higher. No new matter was added; for example, see the present application, as filed, on page 6, line 20.

JP ‘523 fails to define a level of purity or even refer to a high purity product. Rather, it refers to “low cost” and “short” production times. Accordingly, for at least this reason, Applicants respectfully submit that independent claim 24 of the present application is neither anticipated nor obviated by JP ‘523. In addition, one of ordinary skill in the art would have no common sense reason for believing the low cost method of JP ‘523 would produce the same results as the method of the present invention since the methods are completely different.

JP ‘523 discloses a method of producing a copper sulfate solution from metallic copper powder at low cost. Large amounts of fine air bubbles are introduced into a metallic copper powder suspension and sulfuric acid is added thereto while the solution is heated to a temperature of 65 to 85°C. The metallic copper is oxidized and melted to form the solution. No purification or refining steps are disclosed.

In contrast, the method of the present invention dissolves copper sulfate in purified water, performs evaporative concentration, and removes the crystals initially precipitated from further processing. Thereafter, the filtration solution from which the initial crystals were removed is

reheated, water is evaporated, and this was cooled to room temperature so that the refined copper sulfate crystals precipitate and can be filtered.

Accordingly, it is clear that JP '523 describes a method and technology that is entirely different from that of the present invention. Based on the significant differences between the methods, one of ordinary skill in the art would not reasonable expect the same outcome. Thus, the differences between the copper sulfate claimed by the present application and that of JP '523 are not obvious and cannot be made by way of "routine modification". The technical concepts of these methods are so different that it would not be "routine" to modify JP '523 in any way to match the present invention.

Claims 20-23, 25-28 and 32-34 of the present application require the copper sulfate to have a content of transition metals of 3wtppm or less. In addition, new dependent claim 33 requires the copper sulfate to have a content of nickel of 1wtppm or less, and new dependent claim 34 requires the copper sulfate to have a content of nickel of 0.2wtppm. No new matter was added; for example, see the present application, as filed, on page 6, lines 18-19, and page 9, lines 10-11.

JP '523 fails to define a content of transition metals and/or a level of purity. Accordingly, for at least this reason, Applicants respectfully submit that claims 20-23, 25-28 and 32-34 of the present application are neither anticipated nor obviated by JP '523. In addition, one of ordinary skill in the art would have no common sense reason for believing the method of JP '523 would produce the same results as the method of the present invention since the methods are completely different.

Further, claims 21-23, 26-28 and 32-34 of the present application require the copper sulfate to have a content of Ag of 1wtppm or less and a content of Cl of 1wtppm. JP '523 fails to disclose or obviate this limitation and fails to disclose anything relative to the purity of the

material produced. Accordingly, for at least this reason, Applicants respectfully submit that claims 21-23, 26-28 and 32-34 of the present application are neither anticipated nor obviated by JP '523. In addition, one of ordinary skill in the art would have no common sense reason for believing the method of JP '523 would produce the same results as the method of the present invention since the methods are completely different as discussed above in detail.

Still further, claims 22, 23, 27, 28 and 32-34 of the present application require the copper sulfate to have a content of alkali metals and alkali earth metals of 1wtppm or less, respectively. JP '523 fails to disclose or obviate this limitation. Accordingly, for at least this reason, Applicants respectfully submit that claims 22, 23, 27, 28 and 32-34 of the present application are neither anticipated nor obviated by JP '523. In addition, one of ordinary skill in the art would have no common sense reason for believing the method of JP '523 would produce the same results as the method of the present invention since the methods are completely different as discussed above in detail.

Finally, claims 23, 28 and 32-34 of the present application require the copper sulfate to have a content of a Si containing oxide of 10wtppm or less. JP '523 fails to disclose or obviate this limitation. Accordingly, for at least this reason, Applicants respectfully submit that claims 23, 28 and 32-34 of the present application are neither anticipated nor obviated by JP '523. In addition, one of ordinary skill in the art would have no common sense reason for believing the method of JP '523 would produce the same results as the method of the present invention since the methods are completely different as discussed above in detail.

For these reasons, Applicants respectfully request reconsideration and removal of the 35 USC §102(b) and §103(a) rejections of claims 20-31 as being anticipated by or obvious over JP '523.

C. *In the non-final Office Action dated October 16, 2008, claims 20-31 are rejected under 35 USC §102(b) as being anticipated by JP 47-040634 A or, in the alternative, are rejected under 35 USC §103(a) as being obvious in view of JP 47-040634 A.*

In the Office Action, it is stated that JP ‘634 discloses a “high-purity” copper sulfate; however, Applicants respectfully submit that this is an error. JP ‘634 does not refer to high purity or steps for refining the purity of copper sulfate. The Office Action also states that any differences between the subject matter defined in the claims of the present application and that disclosed by JP ‘634 “would have been obvious to one of ordinary skill in the art at the time the invention was made as a ***routine modification***”. Applicants respectfully disagree and respectfully request reconsideration.

As explained in the present application, as filed, on page 1, lines 22-27, there are many end-uses for copper sulfate, and commercially available copper sulfate having a purity of 95wt% to 99.9wt% may well be considered “high purity”.

The present invention relates to a copper sulfate that provides an electrolytic solution for electroplating copper for the purposes of forming circuits and/or wiring of semiconductor devices. Semiconductor devices are continually being miniaturized and as the wiring and circuits become smaller, the presence of impurities, even at “low” levels, becomes a problem and causes such semiconductor devices to be defective. Thus, the present invention advances the state of the art with respect to electrolytic solutions for semiconductor manufacture.

All pending claims of the present application require the copper sulfate to have a purity of 99.99wt% (4N) or higher. New dependent claim 34 requires a purity of 99.999wt% (5N) or higher. No new matter was added; for example, see the present application, as filed, on page 6, line 20. JP ‘634 fails to define a level of purity or even refer to a high purity product.

Accordingly, for at least this reason, Applicants respectfully submit that independent claim 24 of

the present application is neither anticipated nor obviated by JP '634. In addition, one of ordinary skill in the art would have no common sense reason for believing the method of JP '634 would produce the same results as the method of the present invention since the methods are completely different.

JP '634 discloses a method of producing anhydrous copper sulfate by extracting copper sulfate from sulfated and roasted sulfide copper ore. For example, a first step is sulfating and roasting a sulfide copper ore, and thereafter, the second step is to extract copper sulfate in the sintered mine as a tetraammine copper sulfate solution in diluted ammonia water. The solution is separated from the residue and then the concentration of ammonia in the solution is increased and tetraammine copper sulfate crystals are precipitated and separated from the solution. Thereafter, the precipitated crystals are heated to 400 to 800°C and decomposed to obtain anhydrous copper sulfate.

In contrast, the method of the present invention dissolves 250g of commercially available copper sulfate having a purity level of 99.8wt% in 1000ml of purified water at room temperature and heats this to 90°C to evaporate water in a prescribed amount. This is then cooled to room temperature, and initial crystals precipitate and are filtered and removed. Thereafter, the filtration solution from which the initial crystals were removed is reheated, water is evaporated, and this was cooled to room temperature so that refined copper sulfate crystals precipitate and can be filtered.

Accordingly, it is clear that JP '634 describes a method and technology that is entirely different from that of the present invention. Based on the significant differences between the methods, one of ordinary skill in the art would not reasonable expect the same outcome. Thus, the differences between the copper sulfate claimed by the present application and that of JP '634 are not obvious and cannot be made by way of "routine modification". The technical concepts of

these methods are so different and it would not be “routine” to modify JP ‘634 in any way to match the present invention.

Claims 20-23, 25-28 and 32-34 of the present application require the copper sulfate to have a content of transition metals of 3wtppm or less. In addition, new dependent claim 33 requires the copper sulfate to have a content of nickel of 1wtppm or less, and new dependent claim 34 requires the copper sulfate to have a content of nickel of 0.2wtppm. No new matter was added; for example, see the present application, as filed, on page 6, lines 18-19, and page 9, lines 10-11.

JP ‘634 fails to define a content of transition metals and/or a level of purity. Accordingly, for at least this reason, Applicants respectfully submit that claims 20-23, 25-28 and 32-34 of the present application are neither anticipated nor obviated by JP ‘634. In addition, one of ordinary skill in the art would have no common sense reason for believing the method of JP ‘634 would produce the same results as the method of the present invention since the methods are completely different.

Further, claims 21-23, 26-28 and 32-34 of the present application require the copper sulfate to have a content of Ag of 1wtppm or less and a content of Cl of 1wtppm. JP ‘634 fails to disclose or obviate this limitation and fails to disclose anything relative to the purity of the material produced. Accordingly, for at least this reason, Applicants respectfully submit that claims 21-23, 26-28 and 32-34 of the present application are neither anticipated nor obviated by JP ‘634. In addition, one of ordinary skill in the art would have no common sense reason for believing the method of JP ‘634 would produce the same results as the method of the present invention since the methods are completely different as discussed above in detail.

Still further, claims 22, 23, 27, 28 and 32-34 of the present application require the copper sulfate to have a content of alkali metals and alkali earth metals of 1wtppm or less,

respectively. JP '634 fails to disclose or obviate this limitation. Accordingly, for at least this reason, Applicants respectfully submit that claims 22, 23, 27, 28 and 32-34 of the present application are neither anticipated nor obviated by JP '634. In addition, one of ordinary skill in the art would have no common sense reason for believing the method of JP '634 would produce the same results as the method of the present invention since the methods are completely different as discussed above in detail.

Finally, claims 23, 28 and 32-34 of the present application require the copper sulfate to have a content of a Si containing oxide of 10wtppm or less. JP '634 fails to disclose or obviate this limitation. Accordingly, for at least this reason, Applicants respectfully submit that claims 23, 28 and 32-34 of the present application are neither anticipated nor obviated by JP '634. In addition, one of ordinary skill in the art would have no common sense reason for believing the method of JP '634 would produce the same results as the method of the present invention since the methods are completely different as discussed above in detail.

For these reasons, Applicants respectfully request reconsideration and removal of the 35 USC §102(b) and §103(a) rejections of claims 20-31 as being anticipated by or obvious over JP '634.

III. Conclusion

In view of the above amendments and remarks, Applicants respectfully submit that the claim rejections have been overcome and that the present application is in condition for allowance. Thus, a favorable action on the merits is therefore requested.

Please charge any deficiency or credit any overpayment for entering this Amendment to our deposit account no. 08-3040.

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